

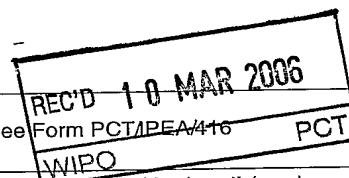
PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference PD030117	FOR FURTHER ACTION	See Form PCT/PEA/416 WIPO PCT
International application No. PCT/EP2004/012480	International filing date (day/month/year) 04.11.2004	Priority date (day/month/year) 05.01.2004
International Patent Classification (IPC) or national classification and IPC INV. H04N7/26		
Applicant THOMSON LICENSING		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 02.11.2005	Date of completion of this report 13.03.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Lombardi, G Telephone No. +31 70 340-4329



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International application No.
PCT/EP2004/012480

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-12 as originally filed

Claims, Numbers

1-10 filed with telefax on 17.02.2006

Drawings, Sheets

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing *(specify)*:
 - ☐ any table(s) related to sequence listing *(specify)*:
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing *(specify)*:
 - ☐ any table(s) related to sequence listing *(specify)*:

* If item 4 applies, some or all of these sheets may be marked "superseded."

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ON PATENTABILITY**

International application No.
PCT/EP2004/012480

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-10
	No: Claims	
Inventive step (IS)	Yes: Claims	8
	No: Claims	1-7,9,10
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents, cited in the International Search Report:

- D1: WO 99/49664 A (HUI YAU WAI LUCAS ; OH HONG LYE (SG); SGS THOMSON MICROELECTRONICS A () 30 September 1999 (1999-09-30);
- D2: EP-A-1 204 279 (IMEC INTER UNI MICRO ELECTR) 8 May 2002 (2002-05-08);
- D3: CICALINI G ET AL: "Dynamic psychovisual bit allocation for improved quality bit rate in MPEG-2 transmission over ATM links" ELECTRONICS LETTERS, IEE STEVENAGE, GB, vol. 32, no. 4, 15 February 1996 (1996-02-15), pages 370-371, XP006004773 ISSN: 0013-5194.

1. The application does not meet the requirements of Article 6 PCT, because some claims are not clear. This lack of clarity notwithstanding, the present application does not satisfy the criteria set forth in Article 33 PCT because the subject matter of several claims does not involve an inventive step (Article 33(3) PCT; Rule 65(1) and (2) PCT).

- 1.1 The subject-matter of claim 1 does not involve an inventive step.

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (the references in parentheses applying to this document) a method for digitally encoding a picture sequence, wherein the frames of said picture sequence are arranged in macroblocks containing pixel blocks and the frames are encoded in bi-directionally-predictive and predictive and/or intra coding types denoted B, P and I, respectively (document D1 refers to MPEG; page 7, line 24-page 9, line 3), and wherein adaptively, for the purpose of overall bit rate control, a specific frame target number of bits is assigned to each one of these coding types, and wherein said overall bit rate control includes a frame-layer rate control and a macroblock-layer rate control which macroblock-layer rate control selects macroblock quantisation parameters (the method disclosed is based on MPEG model TM5, page 9, lines 5-14), said method including the steps of:

assigning a target number of bits to anchor frames, but not assigning a target number of bits to non-anchor frames (the claim appears to be supported by the filed description, page 8, lines 28-34; page 10, lines 1-13, which makes clear that a target number of bits is not assigned to non-anchor frames per se, but always in combination with one anchor frame, as also clear from the subject-matter of claim 5; however claim 3 in document D1 defines an assignment of a target bit rate for a "segment", where the "segment" is an anchor frame or a group of frames made of an anchor frame and at least one non anchor frame, but never made only by non anchor frames);
coding anchor frames using macroblock-layer rate control by adaptive macroblock quantisation parameters (page 9, lines 10-14).

- 1.2 The subject-matter of claim 1 therefore differs from this known method in the feature that the coding of non-anchor frames is performed without macroblock-layer rate control by using fixed macroblock quantisation parameters.

The problem to be solved by the present invention may therefore be regarded as improving bit rate control (filed description, page 4, lines 7-10), which is a well known problem.

- 1.3 The feature shown in section 1.2 is described in document D2 (paragraph [0096]) as providing the same advantages as in the present application (filed description, page

3, lines 8-12). The skilled person would therefore regard it as a normal design option to include this feature in the method described in document D1 in order to solve the problem posed.

Therefore, the subject matter of claim 1 does not involve an inventive step (Article 33(3) PCT; Rule 65(1) and (2) PCT).

1.4 Due to parallel reasons, also the subject-matter of independent claims 2, 10, mirroring claim 1, is not inventive in the sense of Article 33(3) PCT with Rule 65(1) and (2) PCT.

2. Dependent claims 3-7, 9 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to inventive step, because the additional features are either obvious or well known in the prior art as from the following.

Claims 3, 7

The features added over the independent claims are disclosed or rendered obvious by the disclosure in document D2 (paragraph [0096]).

Claims 4-6, 9

Claim 9 lacks clarity in the sense of Article 6 PCT, due to the relative wording "rarely" (claim 9, line 8), which will be ignored.

This lack of clarity notwithstanding, the features added over the claims to which they refer are disclosed or rendered obvious by the disclosure in documents D1 and D3. In particular, the method claimed is straightforwardly derived from MPEG model TM5, applied to the special case of a group of frames containing only a I- or P-frame, followed only by B-frames. The classical MPEG model TM5 formulas (disclosed e.g. in document D1, page 10, line 16-page 11, line 15) may be simplified to a form as disclosed in current application, cf. document D3 (page 370, right-hand column, last typographic paragraph-page 371, left-hand column, first typographic paragraph).

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(SEPARATE SHEET)**

International application No.

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- 2.1 The combination of the features of dependent claim 8 is neither known from, nor rendered obvious by, the available prior art. Indeed, the available prior art, in particular the MPEG model TM5, cited in paragraph 2 above, does not disclose or suggest in any way the updating law of the weighting factor as disclosed by present claim 8.

Claims

- 5 1. Method for digitally encoding (10 - 19) a picture sequence, wherein the frames (FRM) of said picture sequence are arranged in macroblocks (MB) containing pixel blocks and the frames are encoded in bi-predictive and predictive and/or intra coding types denoted B, P and I, respectively, and wherein adaptively, for the purpose of
10 overall bit rate control, a specific frame target number of bits is assigned to these coding types, and wherein said overall bit rate control includes a frame-layer rate control and a macroblock-layer rate control which macro-
15 block-layer rate control selects macroblock quantisation parameters, said method being characterised by the steps:
- assigning (10) a target number of bits to anchor frames but not assigning a target number of bits to non-anchor frames;
 - 20 - coding the macroblocks of said anchor frames (P, I) using macroblock-layer rate control (10) by adaptive macroblock quantisation (12) parameters, and coding the macroblocks of said non-anchor frames (B) without macroblock-layer rate control (10) by using fixed macroblock quantisation
25 (12) parameters.
2. Apparatus for digitally encoding (10 - 19) a picture sequence, wherein the frames (FRM) of said picture sequence are arranged in macroblocks (MB) containing pixel blocks
30 and the frames are encoded in bi-predictive and predictive and/or intra coding types denoted B, P and I, respectively, and wherein adaptively, for the purpose of overall bit rate control, a specific frame target number of bits is assigned to these coding types, and wherein
35 said overall bit rate control includes a frame-layer rate control and a macroblock-layer rate control which macroblock-layer rate control selects macroblock quantisation parameters, said apparatus being characterised by:

- means (10) for assigning a target number of bits to anchor frames but not assigning a target number of bits to non-anchor frames;
- means (11 - 18) for coding the macroblocks of said anchor frames (P, I) using macroblock-layer rate control (10) by adaptive macroblock quantisation (12) parameters, and for coding the macroblocks of said non-anchor frames (B) without macroblock-layer rate control by using fixed macroblock quantisation (12) parameters.

3. Method according to claim 1 or apparatus according to claim 2, wherein the quantisation (12) parameter used for the coding of non-anchor frames in a current group of frames is directly derived (10) from the average quantisation (12) parameter of the previously encoded anchor frame belonging to that group.

4. Method or apparatus according to one of claims 1 to 3, wherein for the bit rate control for the anchor and non-anchor frames inside a current one of said groups a weighting factor $f_{\text{Group-BP}}$ or $f_{\text{Group-I}}$ is used, which weighting factors are adaptively controlled during the encoding of said picture sequence and specify the estimated ratios of the number R_{NA} of bits used for encoding a non-anchor frame to the number R_{A-BP} of bits required for encoding an anchor frame if it is coded as P or B frames, or R_{A-I} if it is coded as I-frame:

$$f_{\text{Group-BP}} = \frac{R_{NA}}{R_{A-BP}}, \quad f_{\text{Group-I}} = \frac{R_{NA}}{R_{A-I}}.$$

5. Method or apparatus according to claim 4, wherein for initialisation at the beginning of encoding a picture sequence said weighting factors $f_{\text{Group-BP}}$ and $f_{\text{Group-I}}$ are set to:

$$f_{\text{Group-BP}} = \frac{1}{2}, \quad f_{\text{Group-I}} = \frac{1}{10}.$$

6. Method or apparatus according to claim 4 or 5, wherein
based on a number $\hat{R}_{Group-BP}$ or $\hat{R}_{Group-I}$ of target bits for a
current one of said groups, the frame target bit number
5 \hat{R}_{A-BP} or \hat{R}_{A-I} for the anchor frame is:

$$\hat{R}_{A-BP} = \frac{\hat{R}_{Group-BP}}{(1 + N_{NA} \cdot f_{Group-BP})} \quad \text{or} \quad \hat{R}_{A-I} = \frac{\hat{R}_{Group-I}}{(1 + N_{NA} \cdot f_{Group-I})}, \text{ respectively,}$$

wherein N_{NA} denotes the number of non-anchor frames in-
side that current group, and whereby a corresponding ac-
curate macroblock-layer rate control is used.

7. Method or apparatus according to one of claims 4 to 6,
wherein the non-anchor frame or frames of a current one
of said groups are encoded using a fixed quantisation
15 step size of $Q_{NA} \approx 1.2 \cdot \overline{Q_A}$, where $\overline{Q_A}$ denotes the average
quantisation step size that was used for encoding the an-
chor frame of that group.

8. Method or apparatus according to one of claims 4 to 7
20 wherein, after a current one of said groups has been en-
coded completely, said weighting factors $f_{Group-BP}$ and
 $f_{Group-I}$ are updated in that weighting factors for said
current group are determined by

$$\tilde{f}_{Group-BP}(n_{Group-BP}) = \frac{1}{N_{NA} \cdot R_{A-BP}} \cdot \sum_{k=1}^{N_{NA}} R_{NA}(k) \quad \text{or}$$

$$\tilde{f}_{Group-I}(n_{Group-I}) = \frac{1}{N_{NA} \cdot R_{A-I}} \cdot \sum_{k=1}^{N_{NA}} R_{NA}(k), \text{ respectively,}$$

wherein $R_{NA}(k)$ is the number of used bits for the k-th
non-anchor frame inside said current group, R_{A-BP} and
 R_{A-I} are the number of bits used for encoding the anchor
frames as P/B-frame or as I-frame, respectively, and
30 $n_{Group-BP}$ and $n_{Group-I}$ are continuously increasing indi-
ces for said weighting factors,
and wherein the weighting factors to be used for follow-
ing groups are each calculated as corresponding average

values of the weighting factors used for several, e.g. five, of the last encoded groups.

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9. Method or apparatus according to claim 4 wherein, if Intra frames are coded rarely, both said weighting factors $f_{\text{Group-BP}}$ and $f_{\text{Group-I}}$ are updated at the same time by using an adaptively controlled weighting factor $f_{\text{BP-I}} = R_{\text{A-BP}}/R_{\text{A-I}}$, which specifies the estimated bit-rate ratio of anchor frames coded as P/B-frames and anchor frames

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coded as I-frames, such that $f_{\text{Group-I}} = \frac{f_{\text{Group-BP}}}{f_{\text{BP-I}}}$.

- 10 Method for digitally decoding an encoded picture sequence, wherein the frames (FRM) of said picture sequence are arranged in macroblocks (MB) containing pixel blocks and the frames were encoded in bi-predictive and predictive and/or intra coding types denoted B, P and I, respectively, and wherein adaptively, for the purpose of overall bit rate control, a specific frame target number of bits was assigned to these coding types, and wherein said overall bit rate control included a frame-layer rate control and a macroblock-layer rate control which macroblock-layer rate control had selected macroblock quantisation parameters,
- wherein a target number of bits was assigned to anchor frames but was not assigned to non-anchor frames, and wherein the macroblocks of said anchor frames (P, I) were coded using macroblock-layer rate control (10) by adaptive macroblock quantisation (12) parameters, and the macroblocks of said non-anchor frames (B) were coded without macroblock-layer rate control (10) by using fixed macroblock quantisation (12) parameters, said method including the step of:
- 35 - decoding said anchor frames (P, I) using correspondingly adaptive macroblock quantisation parameters, and decoding said non-anchor frames (B) using only fixed macroblock quantisation parameters.